A Vegetation Analysis of Sand Scrub Habitat, Boyd Hill Nature Preserve, St. Petersburg, Florida

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Preface

Craig N. Huegel, PhD, was contracted in fall 2014 to provide a vegetation analysis of scrub habitat within an area identified by staff at Boyd Hill Nature Preserve (Boyd Hill); adjacent and/or circumscribed by the sand scrub trail. Boyd Hill is a unique 245-acre natural area at the southern end of Pinellas County, owned and managed by the City of St. Petersburg. The natural lands within its borders contain a diverse assemblage of natural communities including freshwater wetlands adjacent to Lake Maggiore, temperate hammock, pine flatwoods, and sand pine scrub. The scrub is especially significant as it is classified as a "globally imperiled ecosystem" by the Florida Natural Areas Inventory and the approximately 6 acres of scrub habitat accessible by the scrub trail comprises most of this ecosystem remaining in preservation within Pinellas County. It also is significant floristically as it contains the only known population of various state-listed plants in Pinellas County; most significantly the state-endangered Nuttal's rayless goldenrod (*Bigelowia nuttallii*) and Curtiss' milkweed (*Asclepias curtissii*). The site also is the most significant location for the reintroduced federally endangered Florida goldenaster (*Chrysopsis floridana*). A large population of the state-threatened gopher tortoise (*Gopherus polyphemus*) resides in the upland habitats of Boyd Hill, especially within the scrub portion. Diamondback rattlesnakes (*Crotalus adamanteus*) are common as well, though the federally threatened Eastern indigo snake (*Drymarchon couperi*), though historically present here, may have been recently extirpated (George Heinrich, personal communication). Boyd Hill maintains an especially active land management program that includes an aggressive program to eradicate all invasive non-native vegetation and native species deemed inappropriate for habitats in which they occur. As part of that program, various hardwoods, such as red maple (*Acer rubra*) and cabbage palm (*Sabal palmetto*) are targeted for eradication within the scrub. An active program of prescribed fire also is maintained in appropriate habitats, including the scrub analyzed in this study. Because scrub is the most unique and sensitive habitat within Boyd Hill and because recent information on the floristic characteristics of this area is lacking, this study was contracted. Fieldwork was conducted September-November 2014 to measure various vegetation parameters deemed useful measures of vegetation composition and structure; the results of which are reported below.

Methods

Fieldwork was conducted weekly from September-November 2014 by Craig N. Huegel and a student assistant, Shannon Sennokossoff. Dr. Huegel served as the lead biologist while Mr. Sennokossoff recorded the data on prepared data sheets. The majority of data collected was by line transect. Line transects were performed using a stratified random block design in an effort to randomly sample all regions of the sand scrub area delineated on a map provided us by Barbara Stalbird, Nature Preserve Supervisor II. Transects consisted of 100-foot linear samples, measured in 0.1-foot increments. Along each transect, data was

recorded of each species that intercepted the line and the length of that interception. Information on bare ground was also recorded. Additionally, the canopy coverage of mature trees was estimated by projecting the canopy to the line below. Transects were aligned on a north-south orientation for consistency and to avoid the potential for any transect to bisect another. In most locations, 2-3 transects were sampled at each location with a break between each of approximately 50 feet. Once complete, the next line of transect samples was performed approximately 300 feet from the previous sampling line. By this method, all general regions of the sand scrub habitat were sampled.

Estimates of percent cover also were measured using a 20 x 50 cm plot; the Daubenmire Square method. Five samples were measured along each transect line at the 10-, 30-, 50-, 70-, and 90-foot point. Observers viewed each plot from above the vegetation and estimated the percent cover of each species to the nearest ten percent. Such data provided more accurate cover data for ground cover plants than provided simply by the line intercept method and served to reinforce the data for this significant aspect of the study.

Relative plant density data was recorded at these five locations along each transect using a 6-foot-tall density pole, divided in 0.4-inch increments. Density-pole data was collected in each of the four cardinal directions at each sampling point and was measured by viewing the pole 3 feet above the ground surface at a distance 6 feet from the pole. Data at each sampling point and from all four cardinal directions was measured as height of vegetation obscuring the pole. Mean plant density was recorded at each sampling point using the mean of the four cardinal direction measurements.

Sampling was conducted at weekly intervals during the fall sampling period and a total of 20 line transects were sampled. Due to inclement weather, no density pole data was collected at Transect #12. The results of our overall sampling effort are provided below.

Results

Species Presence

The vegetation of the sand scrub region of Boyd Hill is relatively diverse compared to most scrub habitat. A total of 61 species were encountered within the area sampled (Table 1). This was comprised of 25 herbaceous species, 14 graminoids, 3 vines, and 19 shrubs and trees.

Most herbaceous species were infrequently encountered (Table 2). Only two occurred in at least half of the 20 line transects (Feay's palafoxia, (*Palafoxia feayi*); grassleaf goldenaster (*Pityopsis graminifolia*) and 17 occurred in five or fewer. The former two species are members of the Asteraceae, produce fluffy seeds that disperse significant distances from the parent plant, and are commonly encountered in a wide variety of upland habitats (i.e. they are not specific to sand scrub). Of the latter, most seemed to occur in discrete regions of the scrub habitat; they were recorded in consecutive lines or in adjacent parallel transect lines 300 feet distant, but not in other transects. The herbaceous component was not uniformly distributed and is evidence that there are ecological differences throughout the region. In nearly half of the transects (n=9), an herbaceous species, not previously

recorded, was encountered for the first time. Familiarity of the study site by the researchers confirmed that several herbaceous species known to occur in this region were not recorded by the sampling design. As the design is best used to interpret overall structure and not the presence of rare and/or widely dispersed individual species, this result is expected. Species known not to have been recorded (Curtiss' milkweed, (*Asclepias curtissii*); velvetleaf milkweed, (*Asclepias tomentosa*); butterfly milkweed (*Asclepias tomentosa*); Nuttall's rayless goldenrod; *Bigelowia nuttallii*) are all widely scattered in this region and present in small discrete populations. All herbaceous species recorded were native to Florida.

Graminoids comprised a significant portion of the species recorded (Tables 1 and 2). Thirteen species of grasses and other graminoids were recorded in the 20 line transects. Wiregrass (*Aristida stricta*) was recorded in all 20 transects; other graminoids were less frequently encountered. None of the other 12 species were recorded in more than seven transects, and only broomsedge (*Andropogon virginicus*) was recorded in more than five. Though the graminoid component of the understory was dominated by wiregrass, only three transects (16, 17, 18) did not have at least one other species present. All graminoids, except vasey grass (*Paspalum urvillei*) was native. A second non-native grass, torpedograss (*Panicum repens*), was recorded in transect 1 using the 20 x 50 cm Daubdenmire square method.

Vines were also a common component of the understory (Table 2), though nearly all of the vine cover was comprised of one genus, greenbrier (*Smilax* spp.). Greenbrier was not identified to species, but was believed to be earleaf greenbrier (*Smilax auriculata*), a species common to most upland habitats in Pinellas County. Greenbrier occurred in 18 of the 20 transects. Only two other vine and/or vinelike species were recorded, muscadine grape (*Vitis rotundifolia*) and dodder (*Cuscuta pentagona*). Muscadine grape occurred in six of the 20 transects, mostly in the western half of the scrub region and dodder was confined to 3 transects, all in the far western section. All species of vines were native.

The shrub and understory tree component was also diverse, comprised of 17 species (Table 2). Most of this, however, was the result of four species (saw palmetto, (*Serenoa repens*); sand live oak, (*Quercus geminata*); chapman oak (*Q. chapmanii*), and myrtle oak, (*Q. myrtifolia*). Saw palmetto occurred in all 20 transects, sand live oak in 19, Chapman oak in 12, and myrtle oak in 10. Only one other species, winged sumac (*Rhus copallina*), occurred in more than five transects. All shrubs and understory trees were native.

Canopy trees were largely absent and those recorded were widely scattered. This component of the flora also was diverse. Canopy trees occurred in only 6 of 20 transects and included 4 species; three species of pine (longleaf pine, *Pinus palustris*; slash pine, *P. elliottii*; and sand pine, *P. clausa*). Longleaf and sand pine occurred in three transects, while slash pine each occurred in two. Turkey oak (*Quercus laevis*) occurred as a canopy tree in one transect. When present, two species formed the canopy in half of the six occurrences.

Species Cover

Table 3 provides data on species cover. Most of the transects (n = 13) exceeded 100 percent cover. This is possible as often more than a single species intercepted the line at a single point. Mean percent cover, based on line transect data was 101.6 percent with a standard deviation 26.3. Such a result indicates a great amount of variability between transects, but very few (n= 4) transects had 75% or less cover. In fact, the median percent cover, 106.8, was very near the mean value.

Conversely bare ground was a relatively small percentage of the overall cover based on line transect data. Only 7 of the 20 transects had more than 20 percent bare ground and an additional 7 had less than 15 percent bare ground. The mean percentage bare ground was 19.4 and the median percentage was 14.7. Variability in this data was great; the standard deviation of 11.6 verifies this. Most patches of bare ground were small, less than 2 feet long, except in transect number 10.

Plant cover was comprised mostly of the graminoid and shrub/understory tree components. The mean percent cover comprised of graminoids based on 20 line transect samples was 37.9 with a standard deviation of 17.2 (median = 44.1). The percent cover comprised of shrubs and understory trees was 45.5 with a standard deviation of 24.6 (median 43.7). This result demonstrates a relatively great amount of variability between transects in this study. The variability also shows that there was no significant difference between the percent cover of the two groups ($p < 0.05$). The percent cover of grasses exceeded the percent cover of shrubs and understory tree species in 9 of 20 transects.

Herbaceous species comprised nearly half of the total species encountered, but did not comprise a large percentage of the total plant cover. Herbaceous plants composed only 8.6 percent of the mean total plant cover (SD = 5.9; Median = 9.4). Herbaceous plants were widely scattered and in discrete and relatively small patches.

Vine cover also was relatively small and very similar to that observed for herbaceous species; mean percent cover 9.7 and median 5.8. The higher standard deviation (SD = 12.7) was a result of two transects (numbers 15 and 20) where coverage exceeded 33%. The former transect had an unusually high percent cover of greenbrier and muscadine grape while the latter had nearly 46 percent cover by dodder. Except for those two exceptions, vines were present in transects, but were scattered and did not form dense thickets.

Nonnatives and Ruderal Species

Nonnative plants and native ruderal species were negligible and comprised an insignificant portion of the understory. Of the 61 species recorded in the area sampled, only one nonnative, vasey grass, was recorded in the 20 line transects in (Numbers 4 and 5) and it comprised only 2.5 and 0.2 feet of the 100-foot transects, respectively. Ruderal native species were also extremely uncommon. One grass common to disturbed sites, finger grass (*Eustachys neglecta*), occurred in the same transects as vasey grass and provided negligible percent cover in those transects (1.1 and 0.1, respectively). Winged sumac (*Rhus copallina*) is the only woody species recorded that could be considered ruderal, though it is resident to various upland habitats in Florida. Winged sumac was recorded in 7 of the 20 transects,

but never comprised more than 3 percent cover of any transect (mean = 1.4, SD = 1.1). Dodder also might be considered an indication of site disturbance. It was recorded in only three transects, all in the far western region of the sand scrub parcel. Though it covered nearly half of transect 20 (46.7%), it covered less than 3% of the other two in which it was present.;

Canopy Trees

Most of the region sampled was open. Canopy trees were widely scattered and, when present, always provided less than 50 percent cover along the transect line (mean = 27.6; SD = 14.1). The percent canopy cover provided by longleaf pine was nearly identical to that provided by sand pine (60 vs 61.2 feet), but all mature sand pines occurred in the three most-western transects within the sand scrub region. Mature longleaf pine all occurred in the central portion of the sampling area. Slash pine were recorded in Transects 12 and 19. The only other canopy tree encountered along the transects was turkey oak. Turkey oak occurred in transect 11 for 18.5 feet of total cover.

Daubenmire Square

Percent understory cover data resulting from the use of the 20 x 50 cm Daubenmire square plot method was similar to that produced by the line transect (Table 4). As evidenced by the line transect data, the sand scrub area sampled was extremely variable in terms of vegetation, even within transect. In order to reduce some of this variability, the mean values for each transect (n=20) were analyzed, based on five samples per transect line.

Though variable, understory cover was dominated by woody plants (mean= 47.6, SD=31.8) and graminoids (mean=36.5, SD=17.6). All transects, except one (Transect 2), had coverage by woody plants and half (n=10) had greater than 40 percent coverage. All transects, except one (Transect 19) had graminoids within the understory and nearly half (n=8) had greater than 40 percent coverage.

The coverage of herbaceous species and vines was extremely variable and generally small, in comparison to woody and graminoid plants. Though herbaceous species generally comprised less than 16 percent cover (mean = 15.7 %), the standard deviation exceeded the mean value (SD = 22.3). Most transects had less than 10 percent cover by vines (mean = 9.5%), but the standard deviation also exceeded it (SD=12.4).

Mean bare ground comprised 17.8 percent of the Daubenmire plots; nearly identical to the value generated by the line transects (19.4%). This value also was quite variable (SD=14.2), but less so than the data for herbaceous plants and vines. Only one transect had no bare ground (Transect 9), but six additional transects had 10 percent or less bare ground.

Density Pole

Data from use of the density pole shows that the scrub evaluation study site is relatively dense (Table 5). The mean height that the pole was obscured was 3.5 feet (SD= 1.5 feet), but in nearly half (n=8) of the transects the pole was obscured at heights greater than 4 feet.

Discussion

The area defined for this scrub evaluation study is typical of scrub found elsewhere in Florida in terms of its woody mid-canopy composition. Typical scrub is generally dominated by woody shrubs within the mid-canopy (Myers 1990), most significantly by myrtle oak, saw palmetto, sand live oak, Chapman's oak, and rusty lyonia in relative order of dominance. High elevation, excessively well-drained, scrub often is dominated by Florida rosemary (*Ceratiola ericoides*), but this species was not encountered, though it does occur in other scrubs within Pinellas County (pers. observation). The other mid-canopy scrub shrub often found in peninsular scrub that was not present was scrub palmetto (*Sabal etonia*). The absence of scrub palmetto, however, was expected as it has not been vouchered for Pinellas County (Wunderlin and Hansen 2011).

Florida scrub, especially typical scrub not dominated by Florida rosemary, is often dense. Though relative density is dependent on fire frequency and increases rapidly following fire, the presence of these three scrub oaks and palmettos creates a dense mid-canopy layer. Though scrub oaks can reach mature heights in excess of 20 feet, they are best maintained below that, and quickly lose their value as nesting habitat for Florida scrub jays (*Aphelocoma coerulescens*) and other scrub birds when they exceed 10 feet (Woolfenden and Fitzpatrick 1984). The scrub measured in this study is being maintained in optimal condition through regular prescribed fire and the shrub component would provide optimal habitat for avian scrub endemics if present. Though Florida scrub jays have been extirpated from Pinellas County for more than six decades, a land management program that maintains optimal conditions for them is significant as it also provides other scrub species optimal habitat, and provides the public a significant educational opportunity to witness this rare habitat in good condition. Overall, the composition of woody mid-canopy shrubs in this study is typical of all but the highest elevation scrubs in peninsular scrub and indicates a healthy ecological condition.

Though the mid-canopy component of this scrub is typical and in excellent ecological condition, the dominance of graminoids and the diversity of forbs in the ground layer in most sample plots is atypical of scrub and more typical of longleaf pine sandhill habitat. Myers (1990), in describing typical Florida scrub, states that "The ground cover, though always sparse…" and "…the density of this ground cover is inversely proportional to the density of sand pines and shrubs." The ground layer in the scrub evaluated in this study was largely dominated by grasses typical of sandhill. This was most evident by the widespread occurrence of wiregrass. Wiregrass is the primary indicator species of the sandhill understory (Myers 1990) and forms a near-universal carpet in well-managed habitat. Wiregrass (and other graminoids) is largely absent from high-quality scrub, but occurred in 100 percent of the line transects sampled at Boyd Hill and 19 of 20 transects

using Daubenmire plots. Nearly 40 percent of the line transects sampled were covered by grasses (median = 44.1%), most commonly wiregrass. Other grasses most commonly encountered, bluestems (*Andropogon* spp.), little bluestem and lop-sided Indiangrass (*Sorghastrum secundum*) also are sandhill indicators. Data generated by the Daubenmire plots further confirms the line transect data. These plots only measure the percent cover of the understory and graminoids comprised 36.5 percent of the ground cover. Woody plants were only slightly more dominant (47.6%).

Though forbs were not a dominant component of the understory compared to woody plants and graminoids, the species encountered and their pattern in the landscape are more typical of sandhill than scrub (Clewell 1986, White and Judd 1985). Though only two species of forbs were found in at least half of the plots (*Palafoxia feayi*, n=13; *Pityopsis graminifolia*, n=11), 24 species were recorded using the line transects and an additional species (*Asclepias tomentosa*) was recorded using the Daubenmire plots. All species native to the site are typical of sandhill (Myers 1990). Only the reintroduced Florida goldenaster and Curtiss' milkweed (*Asclepias curtissii*), not sampled in the study plots, are most typical of scrub. The small population of Nuttall's rayless goldenrod (*Bigelowia nuttallii*), present in the scrub at Boyd Hill, though not present in the study samples, is not a scrub species elsewhere in Florida and occurs on thin, droughty soils over acidic rock. Most forb species were infrequently encountered and widely scattered throughout the study site. This pattern and level of diversity are rare in scrub, but indicative of sandhill.

The overstory of the study area also was not fully representative of scrub. Sand pine is traditionally regarded as the primary diagnostic overstory element of scrub, while longleaf pine assumes the same role in sandhill. In both habitats, the overstory of mature trees is widely scattered. The pattern of the overstory in Boyd Hill was one of widely scattered mature trees, but they were a mixture of species that were not widely dispersed, but found in scattered pockets. Sand pine was most prevalent in the western areas of the study area while longleaf pine was recorded mostly in the central portion of the study area. Slash pine, most indicative of flatwoods also was recorded, but scattered within the study area in no discernible pattern. Other, less common overstory species, such as turkey oak also are indicative of xeric conditions and most common to sandhill habitat.

There are virtually no structural or fertility differences between scrub and sandhill soils (Kalisz and Stone 1984). Other abiotic factors besides soil are the factors that determine vegetation patterns. Typically, scrub is characterized by patchy mid-canopy vegetation and significant open sand in the ground cover layer while sandhill has extensive cover from graminoids and forbs. Bare ground was mostly uncommon within the study area. Only 14.7 percent of the line transects were bare ground and only three had more than 25 percent. As expected, similar results were calculated from the Daubenmire plots. In addition, most patches of bare ground were very small. Extensive patches, devoid of graminoids and forbs in the understory were rarely more than several feet in length and separated by extensive areas of vegetation. Such a vegetation pattern is more characteristic of sandhill.

The study area, though a mixture of sandhill and scrub elements, was in excellent ecological condition and contained very few non-native or ruderal species. Several non-native or ruderal grasses were recorded, but seemed most commonly associated with edges near trails. Of the grasses, only vasey grass and torpedograss are considered to be a non-native. Vasey grass was recorded only in two of the 20 sampling plots and comprised no more than 1 foot of cover (x=0.6 and 1.0) in the two locations. Torpedograss was only encountered once in a Daubenmire plot, but not within a line transect. Ruderal grasses, such as *Eustachys petrea* and *Setaria parviflora*, also were uncommon and provided minimal cover. The one exception is the presence of dodder, most likely five-angled dodder (*Cuscuta pentagona*). This vining native parasite can harm its hosts by debilitating them and making them more susceptible to disease organisms. The species present within the study site is native and may be kept in check through frequent fire, but its spread should be closely monitored to ensure that it doesn't become more widespread. At present, it is most common near the western property boundary and was recorded in only three plots. Dodder can quickly expand outward, once established, but it was a major component of the ground cover only in Plot 20, where it covered nearly 46 percent of the line transect and nearly 100 percent of three of the five Daubenmire plots along that transect. More aggressive control of this species should be considered if this species significantly expands its range and/or becomes established in areas currently occupied by the rarest plant species, especially Nuttall's rayless goldenrod and Florida goldenaster.

The study area is a mosaic of scrub and sandhill elements, in good ecological condition, and managed appropriately. While the mid-canopy woody component is indicative of scrub, the canopy includes a mixture of both scrub and sandhill and the ground layer and open ground are characteristic of sandhill. The overall area sampled is diverse. Though the pattern of mid-canopy woody species (i.e. scrub oaks and saw palmetto) and grasses (wiregrass) was nearly uniform throughout the study area, the forb component varied extensively and suggested small differences in elevation, soils, and microclimate. Though the study area is not fully representative of typical Florida scrub, it is a significant conservation area. Both scrub and sandhill are extremely rare in Pinellas County and areas this extensive, in conservation status, occur almost nowhere outside of Boyd Hill. This rarity is statewide. The Florida Areas Natural Inventory (FNAI) considered both to be globally imperiled communities. The future wise management of this area has statewide significance and is of regional significance given its location within a publically accessible environmental education setting. As a City of St. Petersburg Park, every effort should be made to retain its current level of management and protection.

Table 1 – Species Presence

Scientific Name	Common Name
Andropogon ternarius	Splitbeard bluestem
Andropogon virgnicus	Broomsedge
Aristida stricta	Wiregrass
Asclepias tomentosa	Velvetleaf milkweed
Asimina reticulata	Flatwoods pawpaw
Balduina angustifolia	Honeycombhead
Baptisia lecontei	Pineland wild indigo
Carphephorus corymbosus	Florida paintbrush
Centrosema virginianum	Butterfly pea
Chamaecrista fasciculata	Partridge pea
Chrysopsis floridana	Florida goldenaster
Cnidosculus stimulosus	Tread softly
Crocanthemum corymbosum	Pinebarren frostweed
Cuscuta pentagona	Dodder
Dalea pinnata	Summer farewell
Desmodium spp.	Beggar's tick
Dicanthelium spp.	Witchgrass
Diospyros virginiana	Persimmon
Eragrostis spp.	Lovegrass
Euphorbia spp.	Spurge
Eustachys petraea	Finger grass
Galactia spp.	Milk pea
Gaylussacia dumosa	Dwarf huckleberry
Liatris tenuifolia	Scrub blazing star
Lupinus diffusus	Sky-blue lupine
Lyonia ferruginea	Rusty lyonia
Lyonia lucida	Shiny lyonea
Opuntia humifusa	Prickly pear cactus
Palafoxia feayi	Feay's palafox
Panicum repens	Torpedograss
Paspalum urvillei	Vasey grass
Piloblephis rigida	False pennyroyal
Pinus clausa	Sand pine
Pinus elliottii	Slash pine
Pinus palustris	Longleaf pine
Pityopsis graminifolia	Grass-leaved goldenaster
Polygonella gracilis	Tall jointweed
Polygonella polygama	Scrub buckwheat
Quercus chapmanii	Chapman's oak

Quercus geminata	Sand live oak
Quercus laevis	Turkey oak
Quercus minima	Dwarf live oak
Quercus myrtifolia	Myrtle oak
Rhus copallina	Winged sumac
Rhynchospora colorata	White-topped sedge
Sabal palmetto	Cabbage palm
Schizachrium scoparium	Little bluestem
Serenoa repens	Saw palmetto
Setaria spp.	Foxtail
Smilax spp.	Greenbrier
Solidago odora var. chapmanii	Chapman's goldenrod
Sorghastrum secundum	Lop-sided Indiangrass
unk 3	Unknown herbaceous
Unknown 1	Unknown herbaceous
Unknown 1	Unknown woody
Unknown 2	Unknown herbaceous
unknown sedge	Unknown graminoid
unknown sedge 2	Unknown graminoid
Vaccineum myrsinites	Shiny blueberry
Vitis rotundifolia	Muscadine grape
Ximenia americana	Hog plum

Table 2. Species Occurrence by Line Transect (N=20)

Herbaceous	# Transects
Asclepias tomentosa	0
Balduina angustifolia	3
Baptisia lecontei	2
Carphephorus corymbosus	1
Centrosema virginianum	1
Chamaecrista fasciculata	6
Chrysopsis floridana	3
Cnidosculus stimulosus	4
Crocanthemum corymbosum	5
Dalea pinnata	2
Desmodium spp.	2
Euphorbia spp.	1
Galactia spp.	4
Liatris tenuifolia	7
Lupinus diffusus	3

Opuntia humifusa	5
Palafoxia feayi	13
Piloblephis rigida	1
Pityopsis graminifolia	11
Polygonella gracilis	4
Polygonella polygama	1
Solidago odora	8
Unknown 1	1
Unknown 2	1
Graminoids	
Andropogon ternarius	5
Andropogon virgnicus	7
Aristida stricta	20
Dicanthelium spp.	4
Eragrostis spp.	2
Eustachys petraea	2
Paspalum urvillei	2
Rhynchospora colorata	2
Schizachrium scoparium	5
Setaria spp.	1
Sorghastrum secundum	5
unknown sedge	5
unknown sedge 2	5
unk 3	1
Vines	
Cuscuta pentagona	3
Smilax spp.	18
Vitis rotundifolia	6
Woody	
Asimina reticulata	1
Diospyros virginiana	4
Gaylussacia dumosa	1
Lyonia ferruginea	4
Lyonia lucida	2
Pinus clausa	1
Quercus chapmanii	12
Quercus geminata	19
Quercus laevis	2
Quercus minima	5

Quercus myrtifolia	10
Rhus copallina	7
Sabal palmetto	1
Serenoa repens	20
Unknown 1	1
Vaccineum myrsinites	5
Ximenia americana	8

Table 3. Percent Cover based on Line Transects (N=20)

Vegetation Type	Mean Cover/plot	Standard Deviation	Variance	# Plots	Median
Graminoids	37.9	17.2	16.7	20	44.1
Herbaceous	8.6	5.9	5.7	20	9.4
Vines	9.7	12.7	12.4	20	5.8
Woody	45.5	24.6	24	20	43.7
Bare Ground	19.4	11.7	11.6	20	14.7
Woody Plants					
Saw Palmetto	16.2	13.3	12.9	20	20
Quercus geminata	12	13.7	13.3	20	19
Quercus myrtifolia	5.4	9.2	9.4	20	10
Quercus chapmanii	4.6	5.9	6	20	12
Total Vegetation	101.6	26.3	25.7	20	106.8

Table 4. Mean Vegetation Coverage. 20 x 50 cm Plots (N = 20)

Vegetation Type	Mean Cover	Standard Deviation
Graminoids	36.5	17.6
Herbaceous	15.7	22.3
Vines	9.5	12.4
Woody	47.6	31.8
Bare Ground	17.8	14.2

Table 5 – Vegetation Vertical Density. Robel pole (N=19)

Transect Number	Mean Cover (Inches)	Standard Deviation
1	15.25	3.2
2	4.6	1.5
3	2.8	1.1
4	6.74	3
5	8.0	4.7
6	9.85	3.0
7	6.1	2.2
8	7.8	3.9
9	6.2	2.5
10	10.5	2.6
11	4.3	3.0
13	10.6	6.4
14	12.15	6.0
15	15.25	4.9
16	14.1	4.1
17	11.25	4.2
18	12.3	5.3
19	6.0	1.9
20	5.25	3.0
Overall Mean	8.9	3.7

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